Snow is a very important climate parameter. Any attempt to obtain snow physical properties, mass balance, as well as thermodynamic regimes deserve encouragement and promotion. For this reason, I support authors to publish high-quality datasets which have high potential to benefit earth climate research (ECR). On the other hand, as a reviewer, I would rather tell constructive comments and even criticism, the goal is to improve the quality of the manuscript. For this reason, I have the following comments:

1) I find this manuscript didn't provide the best reading experience. Initially, I printed the manuscript and planned to read it while adding my notes on it, but eventually, I have to abandon such a plan because the text is too small to see comfortably. The authors are strongly suggested using at least 12 font sizes for the revised manuscript.

Re: Sorry for the bad reading experience. Although it is the journal template, we changed the font size.

2) The weakest point of this manuscript is that the authors presented data that has lasted for one season. It would be a much stronger data paper if observations covers multi-seasonal or even multi-decadal scales. On the other hand, one season may also represent a lot of useful information. So, I would like to see some explicit arguments to support just one single seasonal data presentation.

Re: Thanks for the suggestion.

We admit that the dataset is just for one season observation, nevertheless, the daily snow pit observation with coincident microwave and optical radiation data in a full snow season provide the most detailed variation of snow parameters which allow researchers to find more details in snow characteristics and their relationship with remote sensing signatures. The dataset also supplemented the snow observation gap in mid-low snow depth area with relative short snow cover duration. Actually, this dataset has been used to develop snow volume scatter algorithm.

In section 5.1 application, we added a paragraph:

L 451-455: “Although the dataset is just for one season observation, nevertheless, the daily snow pit observation with coincident microwave and optical radiation data in a full snow season provide the most detailed variation of snow parameters which allow researchers to find more details in snow characteristics and their relationship with remote sensing signatures. The dataset also fills the snow observation gap in mid-low snow depth area with relative short snow cover duration.”

However, some limits exist. We added section 5.2 Uncertainties to present the limits.

5.2 Uncertainties (L493-509)

During the experiment, some uncertainties were produced due to irresistible factors. It is reported that the sampling depth of the L-band microwave emission under frozen and thawed soil conditions is determined at 2.5 cm (Zheng et al., 2019). We did not collect subsurface soil moisture, and the L band radiometer observation began on January 30, 2016. Therefore, it is difficult to obtain the ground emissivity in the full snow season based on the data. The soil moisture data at 10 and 20 cm under soil/snow interface cannot be directly used to validate and develop soil moisture retrieval from L band brightness temperature. We hope detailed soil moisture profile will be observed to estimate the subsurface soil moisture to fill the gap.

The grain size data were collected through taking photos. When measuring the length of grains, the grain selection has subjectivity, and the released data are average values. Although the general variation trend can be reflected by the time series of average grain size, some details might be missed. Therefore, the original grain photos could be provided through requesting for authors. In snow melt period, large liquid water content would influence the measurement results of snow fork. So, it is suggested to use small-size snow shovel or cutter to observe layered snow density in future experiments.

One season continuous observation is quite valuable for developing and validate remote sensing method or snow model, although the representativeness of this observation remains unknown. We need more years of observation to endorse or confirm the evolution of snow characteristics.

3) The manuscript is too long, there are a lot of technical details/specifications. I suggest authors move those materials to the appendix. In the main body of the manuscript, authors should mainly focus on descriptions of the observation and illustrations of the results.

Re: Thanks for the suggestion.

Because this is a data paper, other reviewers pay much attention on the technical specifications, and suggested to add the precision of instruments, and standards or specifications for this experimental implementation.

Therefore, combining four reviewers' suggestions, we kept the technical specifications in the main body of the manuscript, and merged 2.2 and 2.3 to shorten the manuscript.

Please see details in section 2.2.

4) The quality of most photos are not good (maybe because those are too small) and many of them are not very informative. I suggest the authors drop most of the photos but enlarge/enhance the size/quality of a few selected ones. The criteria of photo selections should be such that it either helps the readers to understand better the observation site (domain map and landscape) or the data you have collected (snowpits sites). Otherwise, the paper is more like a technical report.

Re: Thanks for the suggestion. We enlarged the photos of grains (Figure A1), the microwave radiometer was added as figure 2 in revised manuscript.

The equipment used for snow pit observation in figure 1 are enlarged and presented in figure 3 and figure 4. The equipment used for automatic observation in figure 1 are enlarged and presented in figure 5 and figure 6.

5) The time series of the figures and some tables can still be improved:

1. a) You have observed, e.g. snow density (fig.8b) at different levels. would it be possible to make a contour plot to show the layering effect of snow density? I believe such a contour plot can offer readers a lot more information to better understand the snow density spatiotemporal variations. The same effect can also apply to figure 9.

Re: Thanks for the suggestion. We tried to use contour plot to express the multi-layer snow density variation, but the result looks a little bit confusion (figure r1). So we used image to show the variation of snow density in all layers (figure r2) .

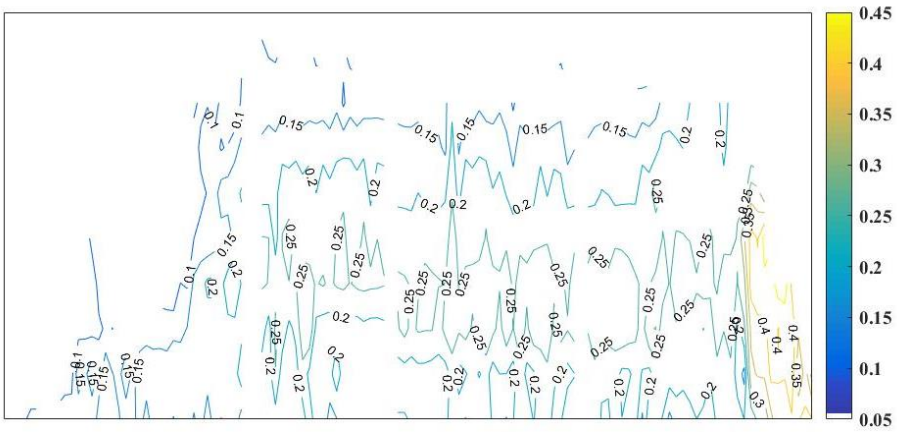


Figure r1 Snow density in contour style.

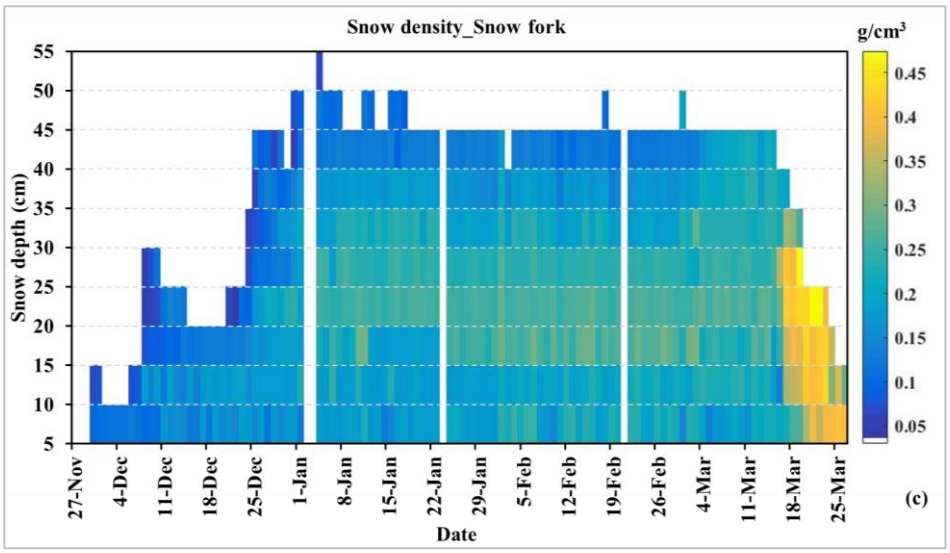
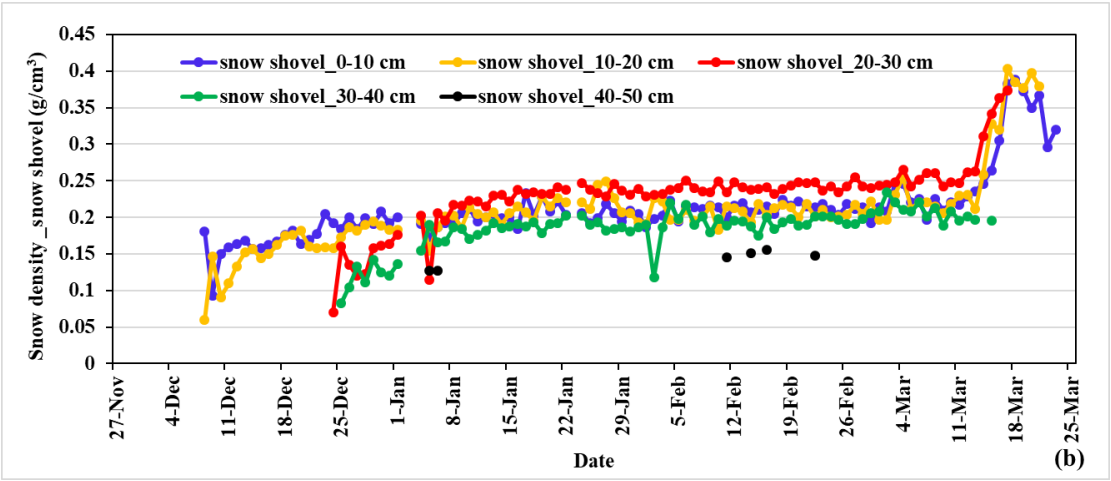


Figure r2 Snow density in image style

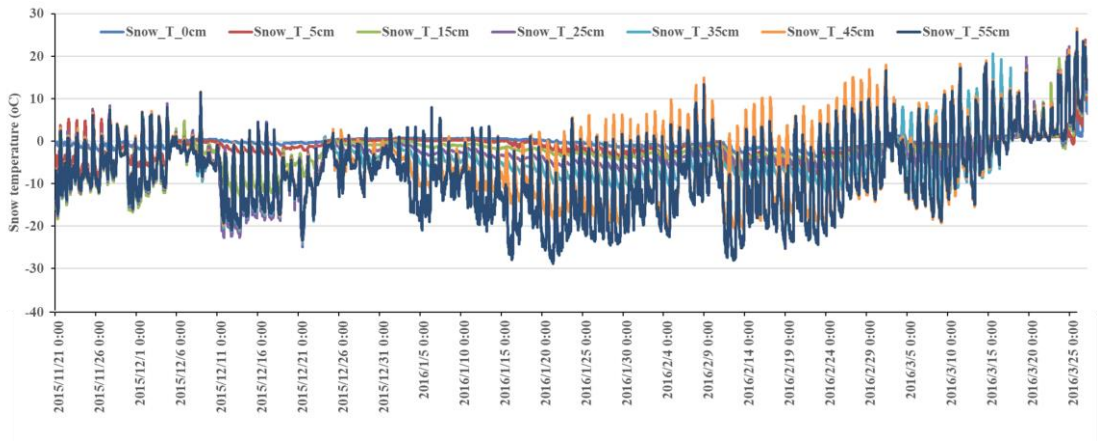
For the figure 8(c), there are 4 layers of snow density. The image style is not suitable to describe them. So, we changed the line color to make them more distinguishable.



2. b) The x-labels of figure 9, 10, 11, 13 are not good, such high resolution and precise timestamp does not help much to understand the time series, e.g. the lines in figure 9 and 13 are so close to each other and we can hardly to see anything clear. I suggest authors use standard time-label, such as "day"

Re: Thanks, we revised the timestamp, and combining other reviewers's suggestion, figure 9, 10, 11, and 13 were revised as below:

figure 9:



Was revised to

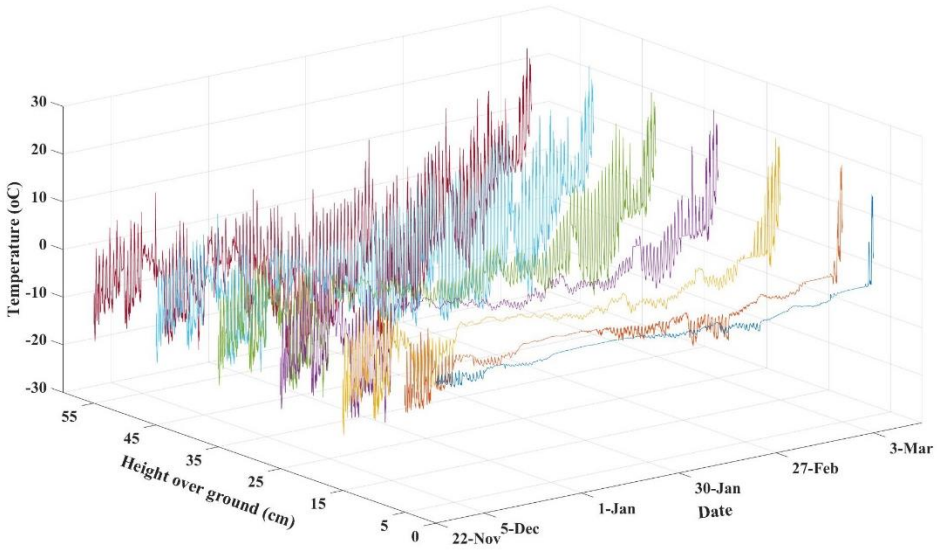
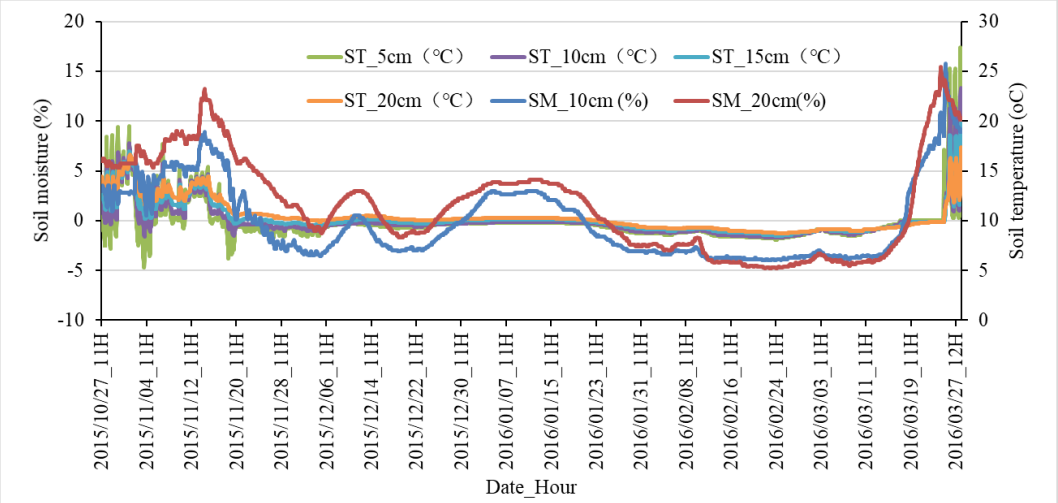


Figure 10: Minutely variation in layered snow temperatures at 0 cm (snow/soil interface), 5 cm, 15 cm, 25 cm, 35 cm, 45 cm and 55 cm above ground during experiment time.

Figure 10：



Was revised to

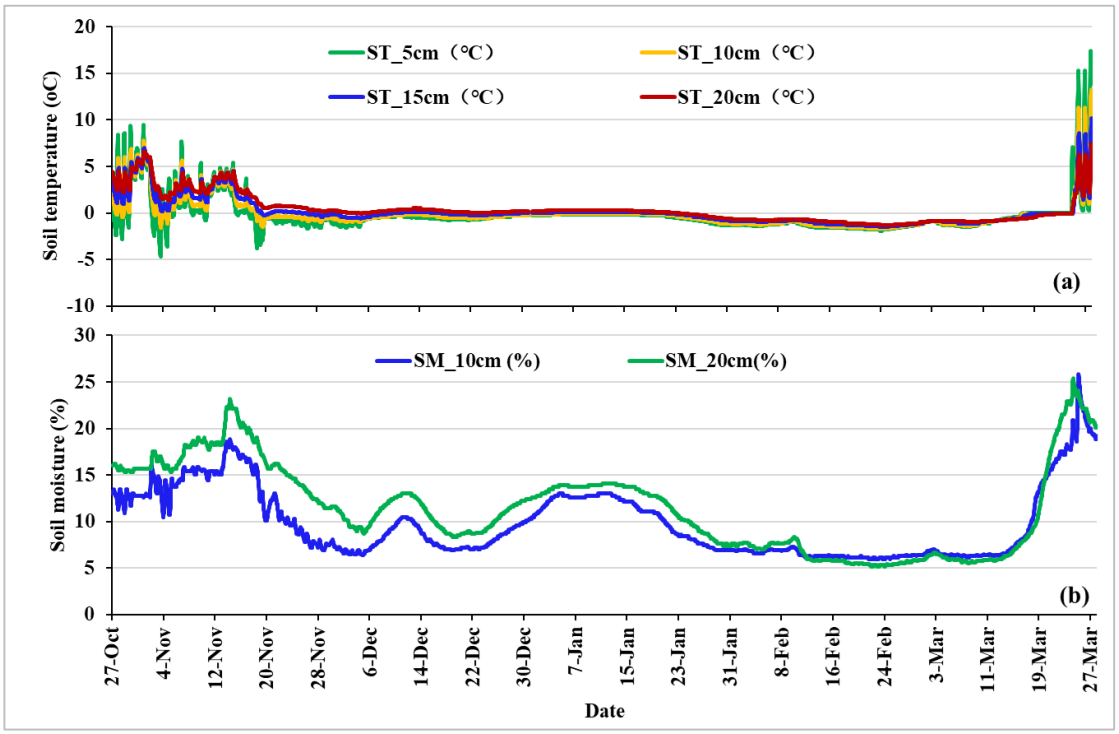


Figure 11: Hourly soil temperature at 5 cm, 10 cm, 15 cm and 20 cm below the snow/soil interface (a), and soil moisture at 10 cm and 20 cm below the snow/soil interface (b).

Figure 11a

1. Figure 11a was divided into two figure. One for H polarization, another for V polarization.

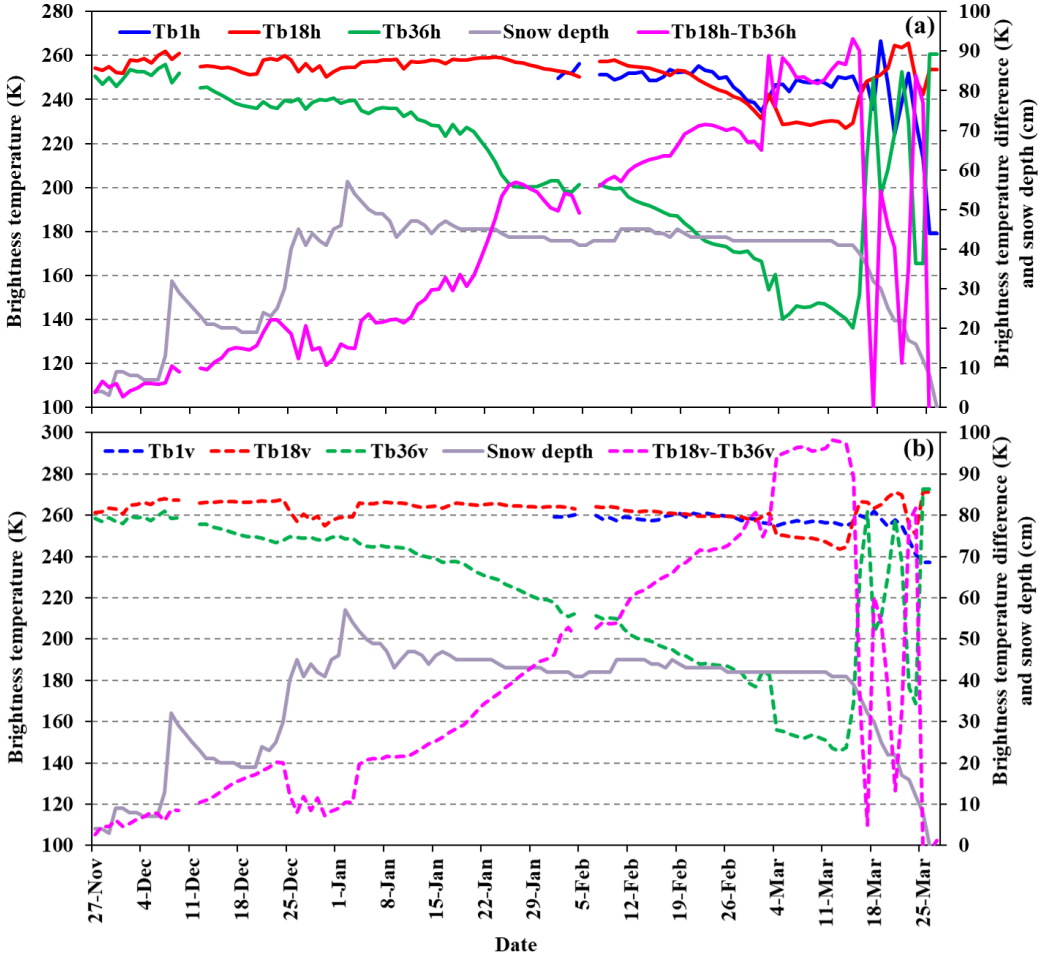
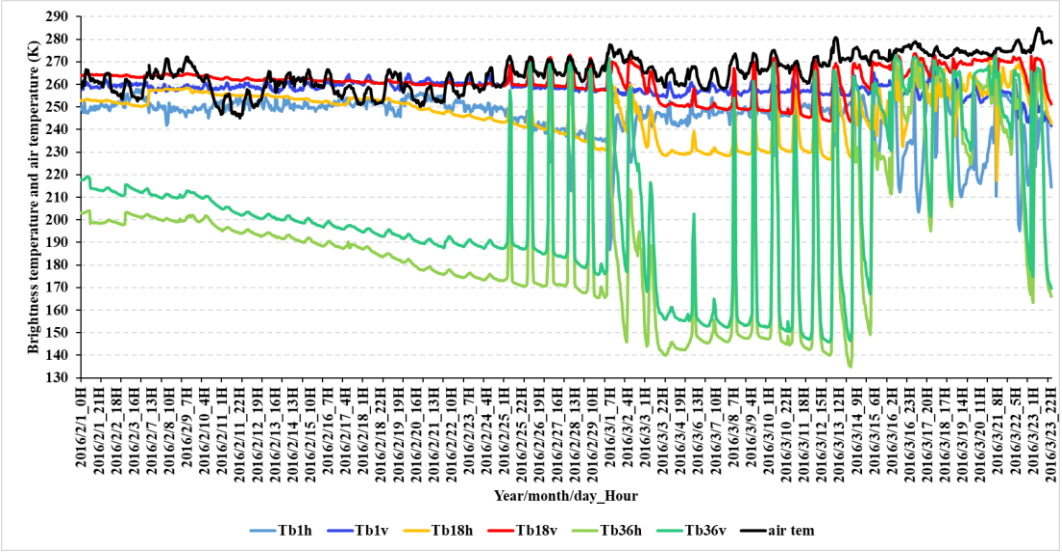


Figure 12: Daily variations in brightness temperatures at 1.4 GHz, 18 GHz and 36 GHz, for horizontal (Tb1h, Tb18h, Tb36h) and vertical polarizations (Tb1v, Tb18v, Tb36v), and the differences between Tb18h and Tb36h (Tb18h - Tb36h, and between Tb18v and Tb36v (Tb18v - Tb36v), at 1:00 am (local time), from November 27, 2015 to March 26, 2016. (a)for horizontal polarization, and (b) for vertical polarization.

2. Figure 11a shows the brightness temperature through the whole snow season. Figure 11b focus on the melting phase. According to the comments, we added the variation in snow depth, soil moisture and soil temperature to link the variation in different parameters.

Figure 11b



was revised to:

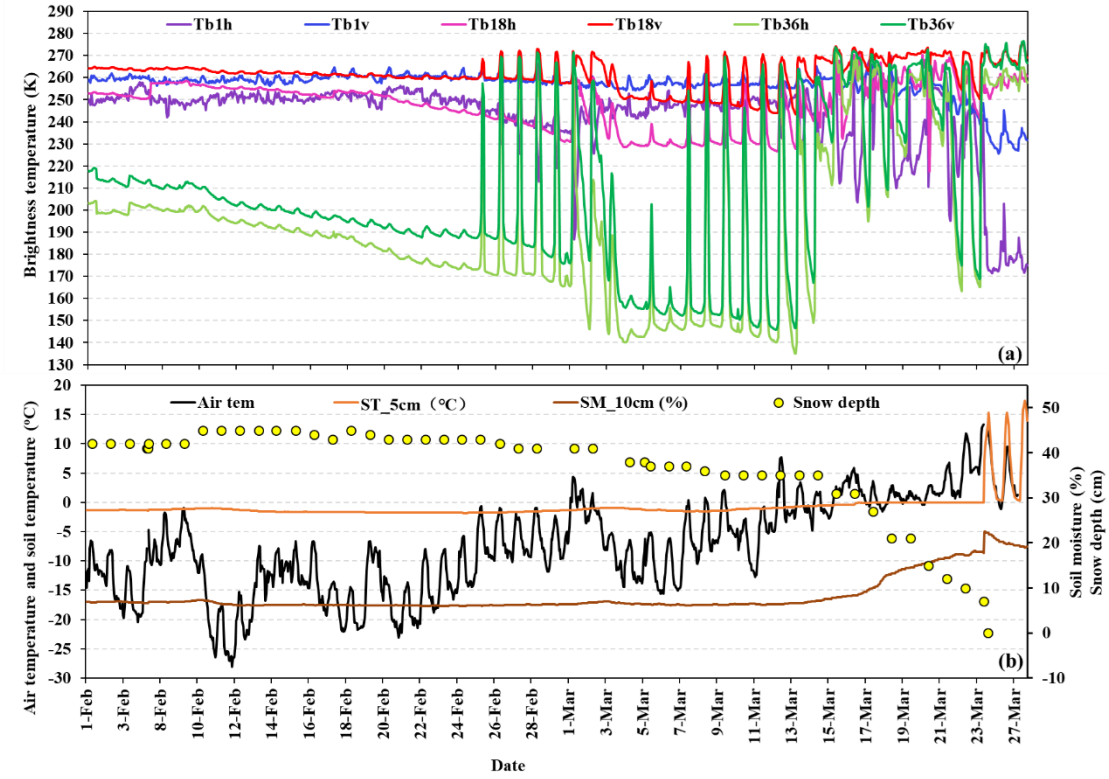
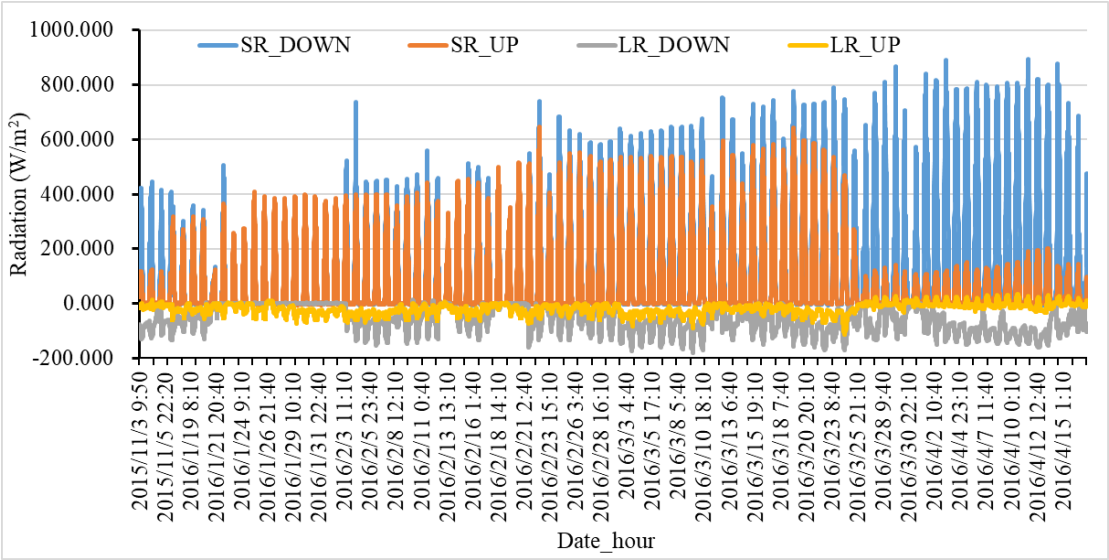


Figure 13 Hourly variation in Tb1h, Tb18h, Tb36h, Tb1v, Tb18v, and Tb36v (a), air temperature, soil moisture at 10 cm and soil temperature at 5 cm, and daily variation in snow depth (b), from February 1 to March 28, 2016.

Figure 13:



was revised to

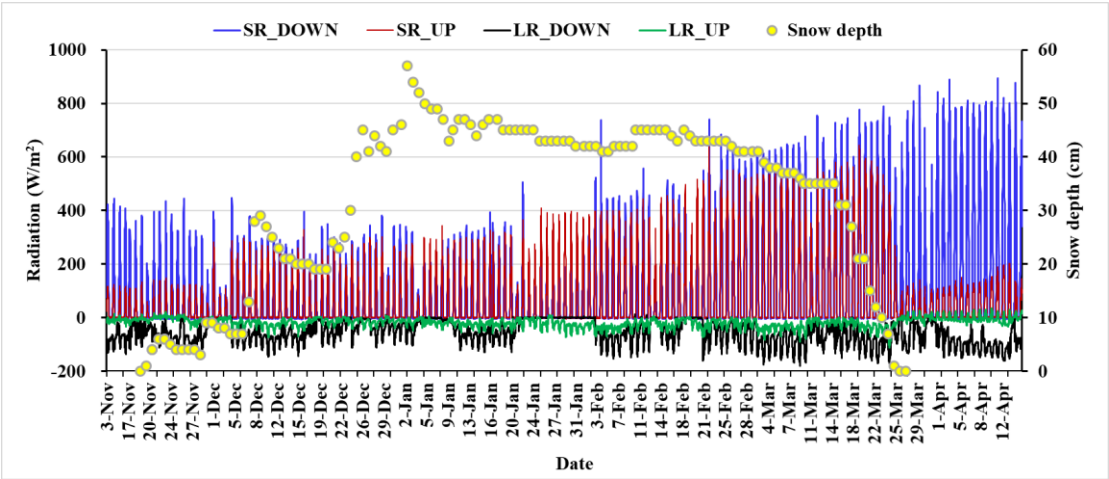


Figure 15: Minutely variation in 4-component radiation and daily variation in snow depth at Altay station from November 3 2015 to April 15 2016.

3. c) Figure A1 needs a major revision. you either enlarge the entire figure substantially or only show a selected example or drop this figure.

Re: We enlarged the entire figure to make sure it more clear. Besides, Figure 3 shows the example of grain photo.

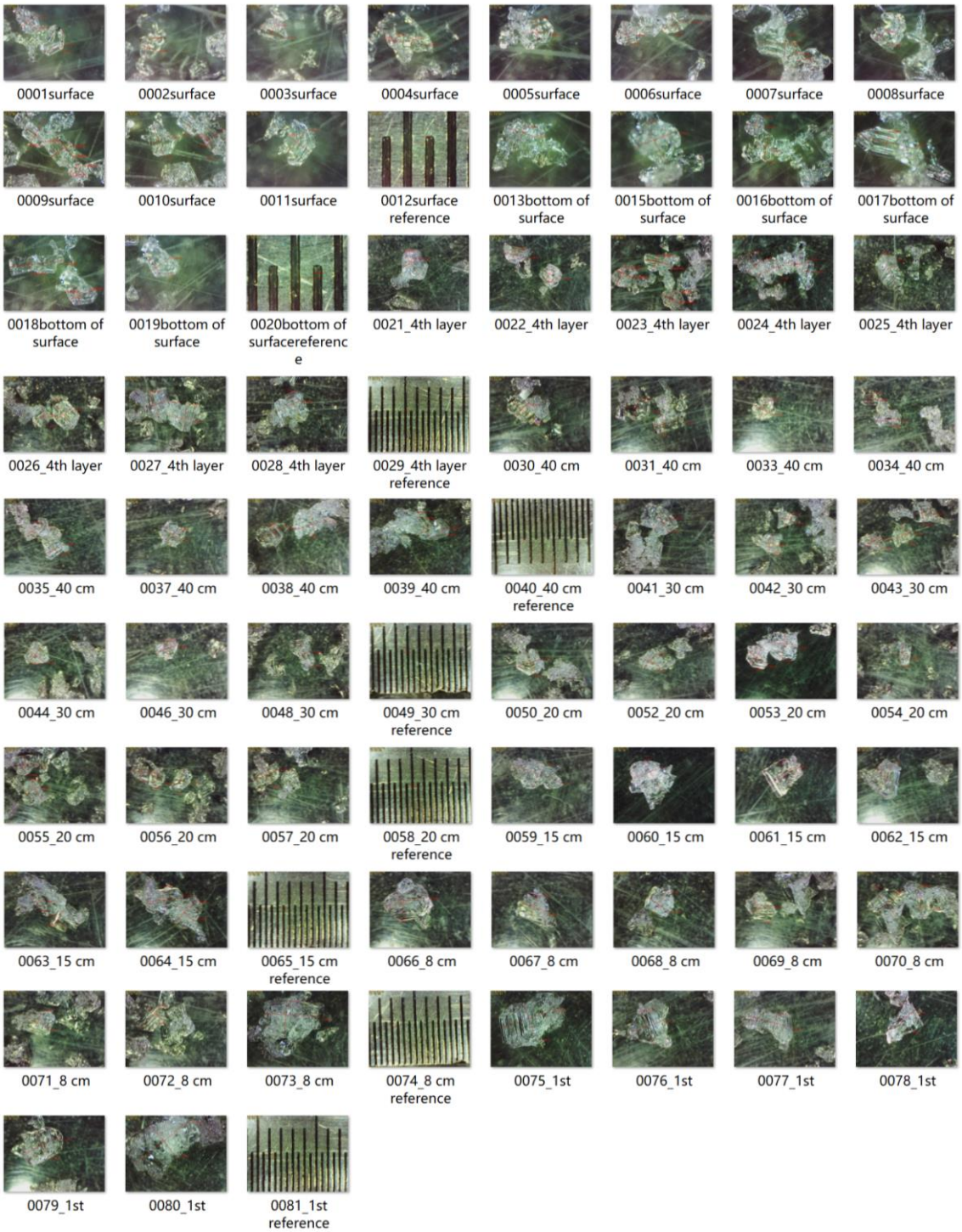


Figure A1: Photos of grains and reference ruler in each layer on February 15, 2016, and in each photo the longest and shortest axis lengths of the chosen grains are labeled.

4. d) Table A2: What do you expect readers to learn from this table? Or what is your message to the readers?

Re: This table presented the original record of snow density to explain measurement for each layer or method was conducted three times. It is just an example to show reader how we record the three kinds of snow density.

6) The conclusion is too short and too superficial. Please give a quantitative summary of what you find from the snow observations. For example, what were the spatiotemporal variation of snow density (I see this is a very important data set and it deserves more attention), snow temperature regimes, and brightness temperature? Anything concluded from the data characteristics need to be described. It will boost the application and citation of your data sets.

Re: Thanks for the suggestion. Summary of data analysis results were added in conclusion.

L 516-520: “Generally, grain size grew with snow age, and increased from top to bottom. Snow grains are rounded shape with small grain size in the top layer, and depth hoar with large grain size in the bottom layer. Snow density experienced increase-stable-increase variation, and the densities of the middle layers were greater than the bottom layer due to the well-developed depth hoar in the stable period.” was added in the second paragraph

L526-527: “Grain size is the most important factor to influence snow volume scattering.” Was added in the third paragraph.

I hope authors may find my comments useful and helpful to make further improvements to their manuscript.

Re: Thank you very much for these constructive comments. They are truly helpful to improve our manuscript.